Space Weather Technical Forecast

Issued on Friday, 04 November 2022 at 13:10 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Decreasing chance of G1/Minor Storms through day 1 and overnight into day 2 (4/5th November). Active fluence (1e8 integrated pfu) becoming likely.

Analysis of Space Weather Activity over past 24 hours
Solar Activity: Solar activity has been Low over the last 24 hours, with a C5 flare peaking at 04/0744 UTC from a new region rotating onto the NE limb. The seven active regions on the disc are largely magnetically simple, stable and relatively inactive. In the northeastern disk AR3137 has seen a slight increase in magnetic complexity. The two new regions rotating onto the NE limb are still difficult to classify as they may not yet be fully visible. No significant Earth directed CMEs have been identified in recent imagery, with the CME emerging from AR3136 near centre disk yesterday expected to miss below Earth's orbit. A further filament liftoff earlier today from the southeast disc is yet to be analysed.

Solar Wind / Geomagnetic Activity: The solar wind, observed by ACE/DSCOVR at L1, is showing the ongoing influence of the HSS from CH39/+. Wind speeds increased from slightly elevated levels to elevated levels early in the period, peaking just above 600 km/s, and are now starting ease with speeds around 550 km/s. Density was average or just above average. Total magnetic field strength, Bt, was moderate to start peaking at 11nT but eased through the period and is now weak. The north-south component, Bz, was largely negative, varying moderately at first but now varying weakly. Phi angle was mainly positive (Away from the Sun). Geomagnetic activity was Unsettled to Active (Kp3-4) with a Minor Storm (G1/Kp5) between 03/1500-1800 UTC.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) as measured at GOES-16 has remained at background levels. High energy electron flux (greater than 2 MeV) at GOES-16 has been at moderate or high levels, with a peak of 2580pfu at 03/1300 UTC. Electron fluence levels were on a declining trend but are now starting to recover, with 4.9e7 integrated pfu observed at 04/0001 UTC.

Four-Day Space Weather Forecast Summary
Solar Activity: Solar activity is likely to be Low, with a slight chance of isolated Moderate activity. Further active regions are likely to rotate onto the visible disc during the period, and these will be assessed as they become visible.

Solar Wind / Geomagnetic Activity: No Earth directed CMEs are currently forecast. The current high speed stream is expected to gradually decline over the coming 24-48 hours, likely to near background levels. A further southern hemisphere coronal hole is just reaching centre disc and may start to give some influence towards the end of Day 4 (07 Nov). Geomagnetic activity is expected to be largely Unsettled to Active on Day 1 (04 Nov), with a chance of isolated G1/Minor Storm intervals, but will gradually ease through the next 24-48 hours to become mainly Quiet. An increase to Unsettled to Active towards the end of Day 4 is possible if we start to see the next coronal hole arrive.

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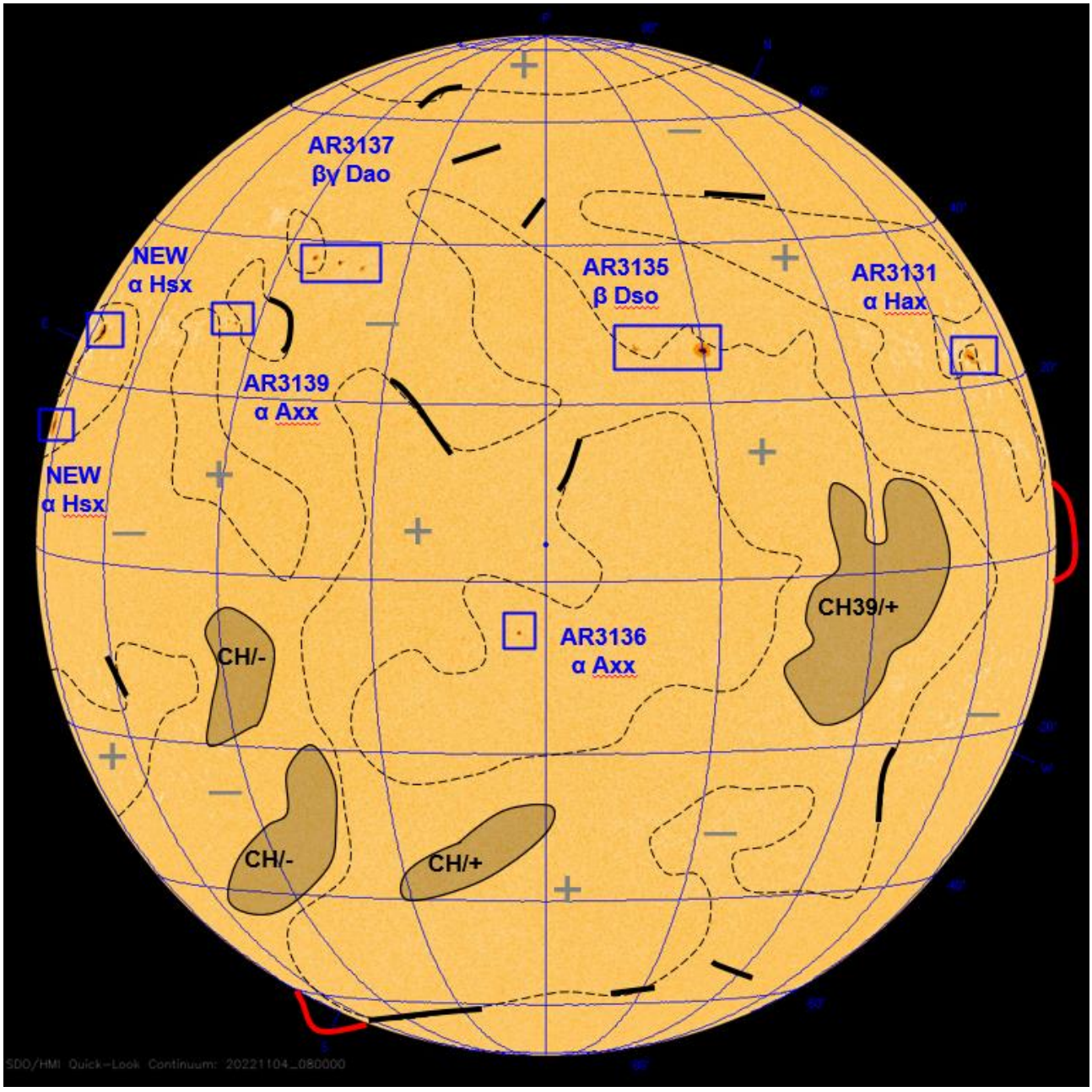
Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) observed by GOES-16 is expected to be at background levels. High energy electron flux (greater than 2 MeV) observed by GOES-16 is forecast to increase slightly to largely high levels. The associated 24 hour electron fluence is currently below the Active (1e8 integrated pfu) threshold but is expected to rise, likely above the Active level.

Figure 1. Solar Analysis Valid 04/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

No Earth directed CMEs are currently forecast, although a filament liftoff earlier this morning is yet to be analysed.

Earth is connected to the high speed stream from coronal hole 39, with elevated wind speeds expected to gradually decline over the coming 24-48 hours, likely to near background levels. Although wind speeds remained elevated for longer than this on the previous rotation, it looks as though the second coronal hole responsible for this has either disappeared or significantly retrogressed. Enlil is currently doing a poor job predicting the solar wind speed as it hasn't captured the current high speed stream. A further southern hemisphere coronal hole is just reaching centre disc and may start to give some influence towards the end of Day 4 (07 Nov).

Geomagnetic activity is expected to be largely Unsettled to Active on Day 1 (04 Nov), with a chance of isolated G1/Minor Storm intervals, but will gradually ease through the next 24-48 hours to become mainly Quiet. An increase to Unsettled to Active towards the end of Day 4 is possible if we start to see the next coronal hole arrive.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	Yes	30	10	1	10
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
*	*	*	*	*	*	*

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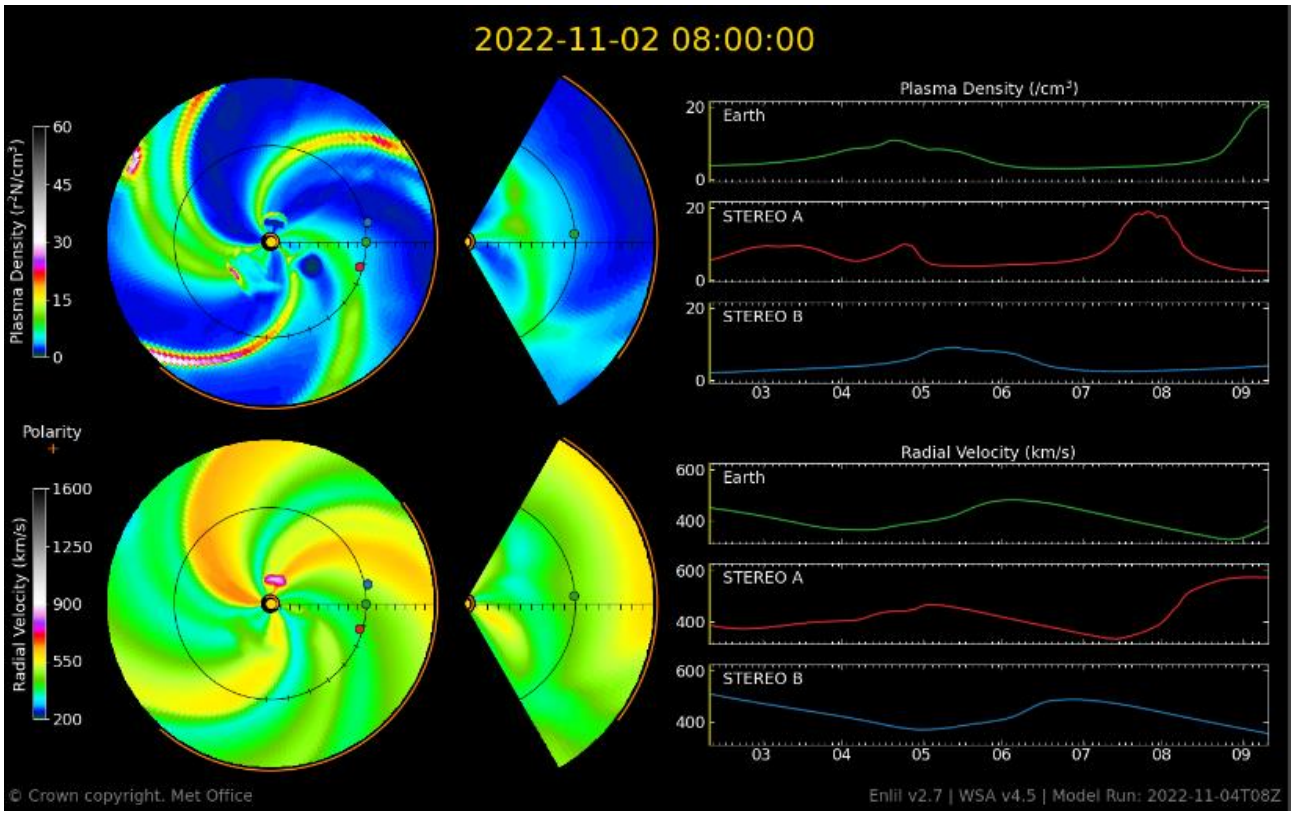
Figure 2: MOSWOC Enlil is currently doing a poor job with the solar wind speeds, having not captured the current high speed stream. Wind speeds are expected to decline from elevated levels over the next couple of days, with an increase possible on 7th – 8th November.



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Radio Blackouts - X-Ray Flares:

There are now seven sunspot regions on the visible disc. Those in the central and western disk all remain relatively simple and mature. In the northeastern disk AR3137 (Dao/Beta-Gamma) has shown some increase in magnetic complexity, but remains small in area. There are two new regions rotating onto the northeast limb, but both are difficult to classify at the present time as they may not yet be fully visible. A C5 flare originated from one of these regions recently, however.

Far side imagery suggests that there may be more to rotate onto the NE limb in the coming day or so, but it is difficult to assess this until it becomes visible on the near side. As such, Low activity is expected to continue with a slight chance of M-class flares.

X Ray Flares / Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**R1-R2 M Class**	No	15	15	15	15
Very Active	**R3 to R5 X Class**	No	1	1	1	1

Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) at GEO, observed by GOES-16 is currently at background levels and is forecast to remain at this level through the guidance period.

Radiation Storms / Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	1	1
Very Active	**≥ S3 ***	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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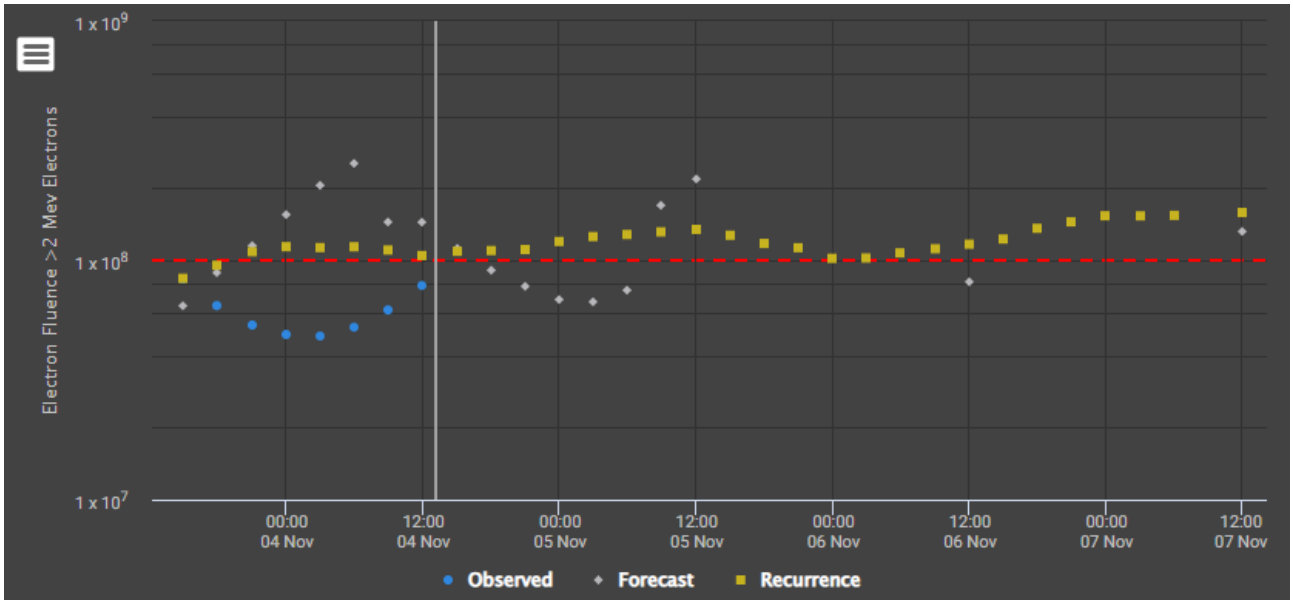
High Energy Electrons Event (≥ 2MeV):
The high energy electron flux (greater than 2 MeV) is currently oscillating between moderate and high levels, after being somewhat knocked back by the recent high speed stream. As the high speed stream eases, electron levels are expected to rise once again as the radiation belt decompresses. It is difficult to say how much further charging may have occurred during the fast winds, so confidence in the magnitude of any increase is low, but an increase to largely high levels seems likely.

The 24 hour electron fluence is currently below the Active (1e8 integrated pfu) threshold but is expected to rise during the next couple of days as the flux starts to increase again. Although the magnitude of any rise is low confidence, it seems likely that fluence levels will go above the Active threshold, given that current readings are not far below that level.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	30	50	60	70
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 3: MOSWOC REFM is forecasting a slight rise in fluence to near or just above Active levels, which seems reasonable, or perhaps a touch underdone.



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